The impact of the implementation of the African Continental Free Trade Area (AfCFTA) on virtual water trade flows

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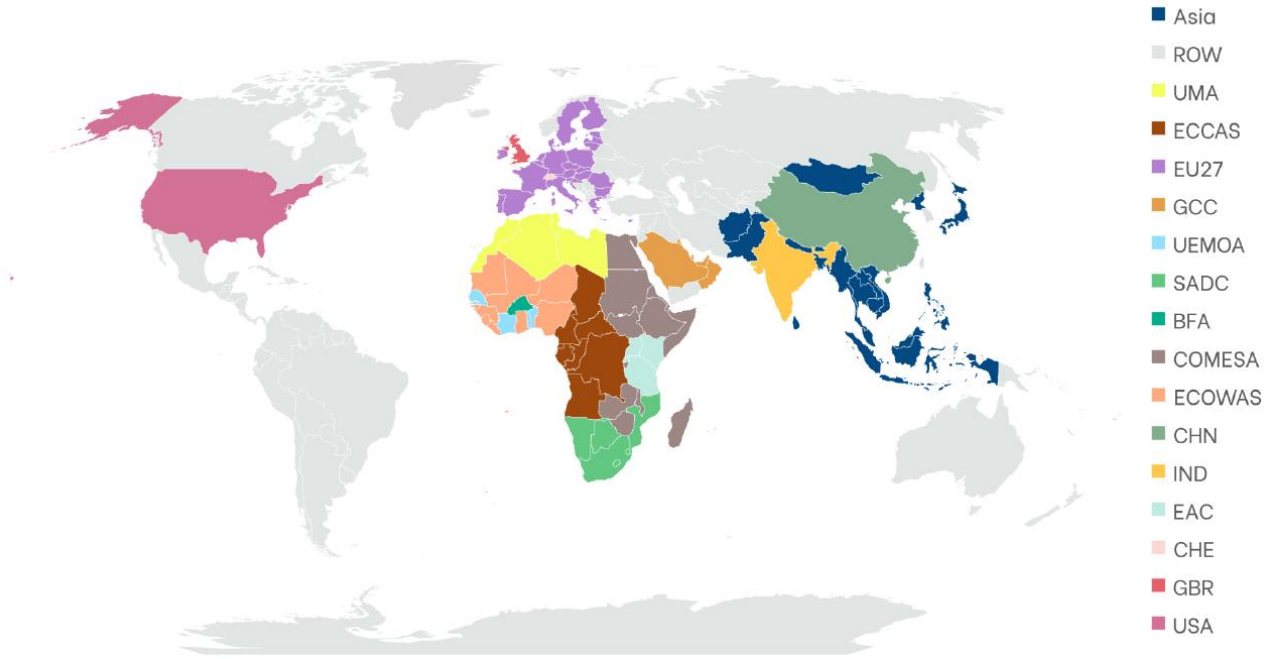
AIM OF RESEARCH:

In this work, we investigate the implications of the implementation of the **AfCFTA** on the ***virtual water trade*** network, namely the water embedded in agricultural products.

In particular, we focus on the impact of AfCFTA on the 7 African regions with a focus on Burkina Faso.

REGIONAL AGGREGATION (17)



8 AGRICULTURAL SECTORS

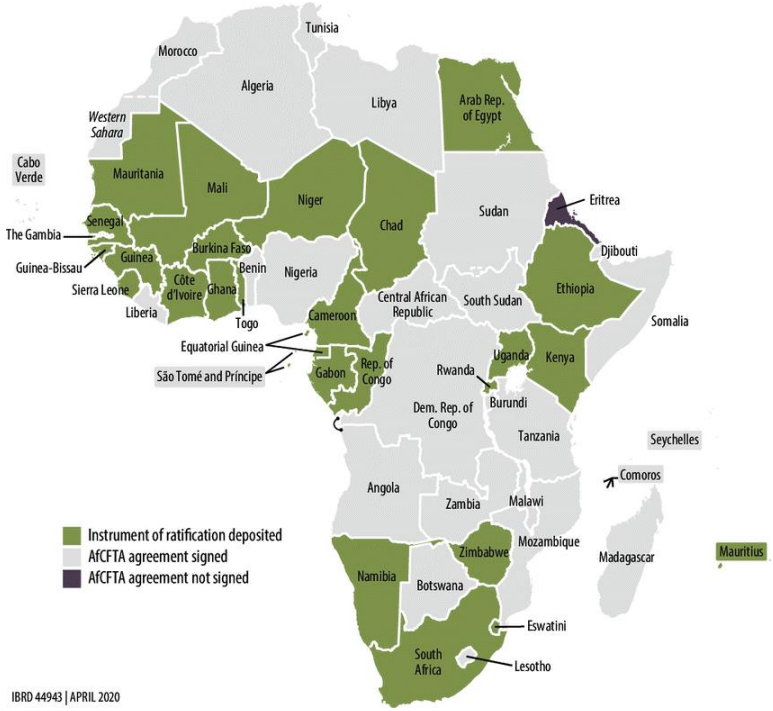
Cereal grains nec	Crops nec	Oil seeds	Paddy rice
Plant-based fibers	Sugar cane, sugar beet	Vegetables, fruit, nuts	Wheat

POLITICAL CONTEXT:

Recently implemented as of 2019, the **African Continental Free Trade Area (AfCFTA)** is anticipated to increase trade within the African continent.

We only consider the **reduction of tariff barriers to intra-regional trade** as the effect of the implementation of the AfCFTA which is expected to have an impact on the agricultural and food system.

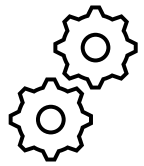
For African continent:

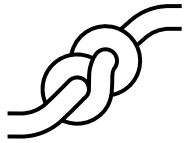


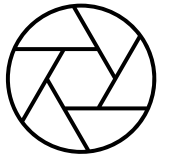
Maliszewska, Maryla, and Michele Ruta. *The African Continental Free Trade Area: Economic and Distributional Effects*. World Bank Group, 2020.

Reduction of tariff → Lower commodity prices → More intraregional trade → More intraregional water traded

STEPS AND PROCEDURES:



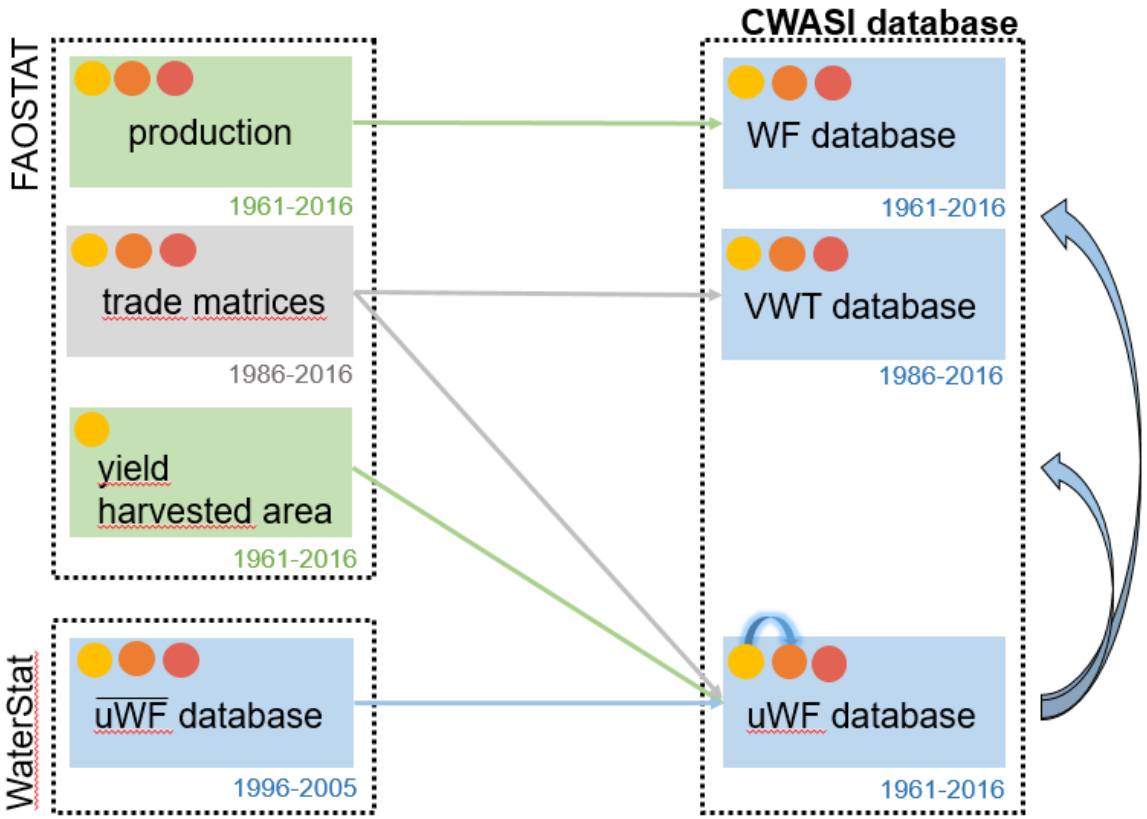




1. Description of tool: CWASI – MAGNET (specifically the use of VW in MAGNET)
2. Historical background: overview of VWT for African regions and BFA
3. Connecting CWASI and MAGNET
4. Policy analysis of the AfCFTA agreement

1) TOOL DESCRIPTIONS

1) CWASI DATABASE



VWT = m3 of water virtually traded
Country scale
- Total, **green**, **blue**;

Detailed trade matrix [VWT]: 1986-2016

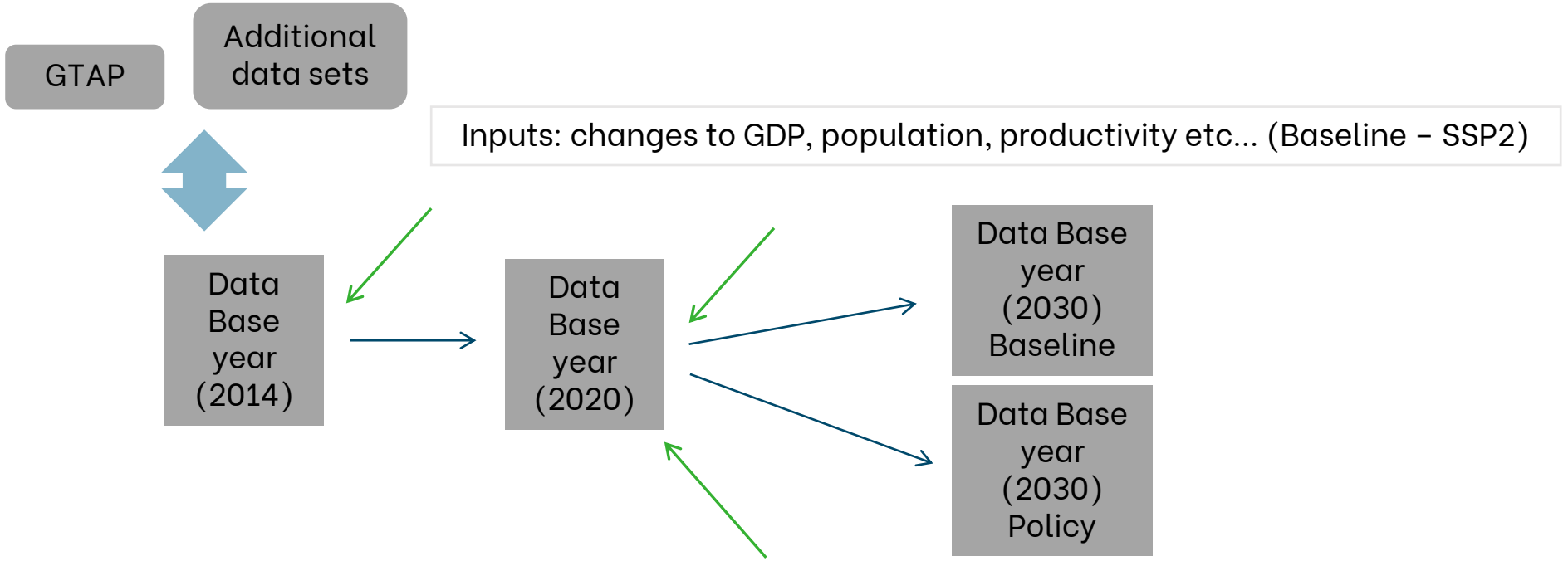
FORM OF ORIGINAL DATA: country reports

NEED TO reconcile importer and exporter reports (if DOUBLE REPORTS)

Procedure from GTAP, based on a «Reliability Index» of each country

In this work we only consider the virtual **blue** water trade, as it is the one that exists in freshwater streams and deposits on the land surface and in groundwater systems, it is vulnerable to overconsumption

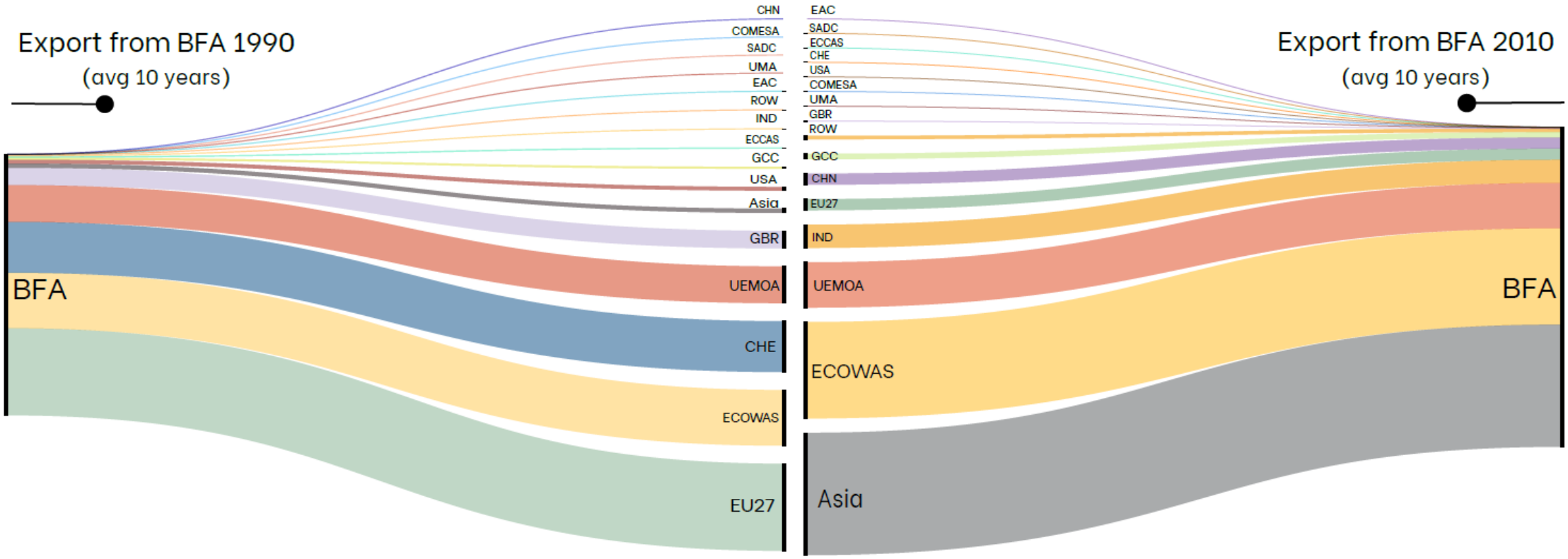
1) MAGNET model: Global CGE macro-economic model- GTAP Core (single year)



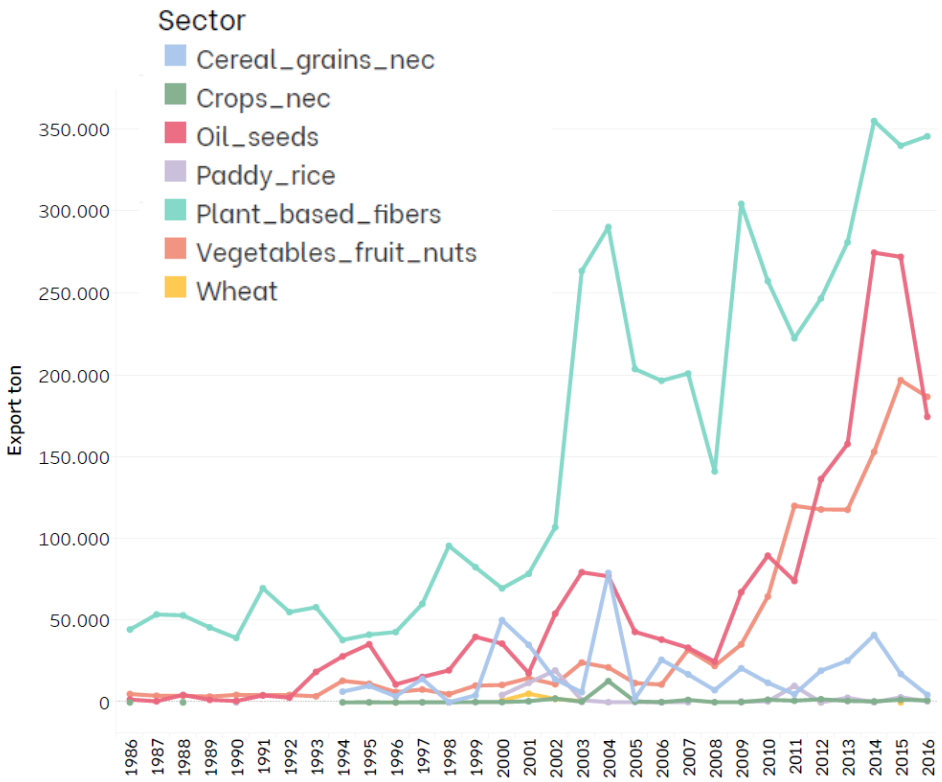
2) HISTORICAL BACKGROUND

2) HOW THE NETWORK CHANGED

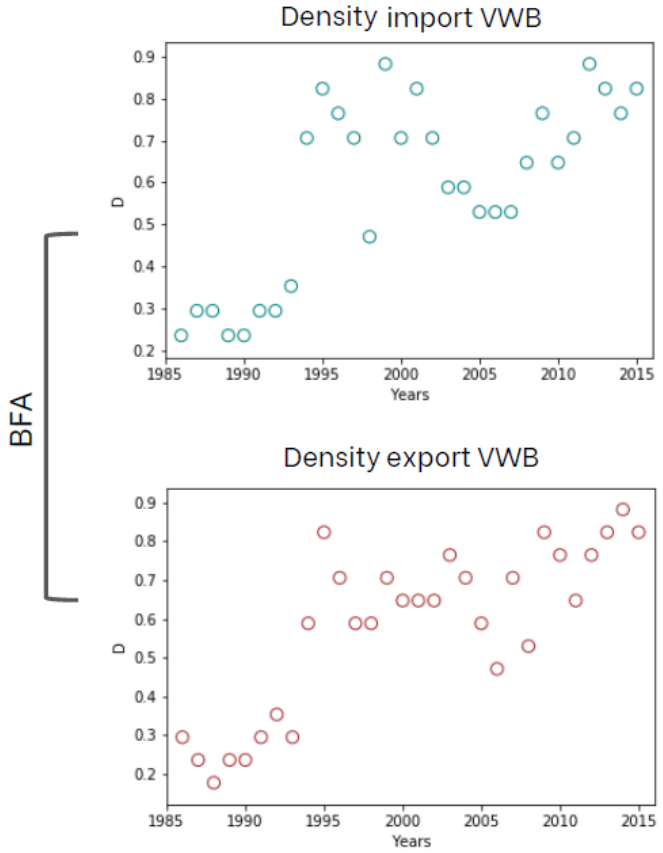
Burkina Faso (BFA) and main trade partners of Blue Virtual Water in 1990 and 2010



2) TRENDS: BFA export



a) Time series of tons exported from Burkina Faso to the other 16 regions considered in the analysis

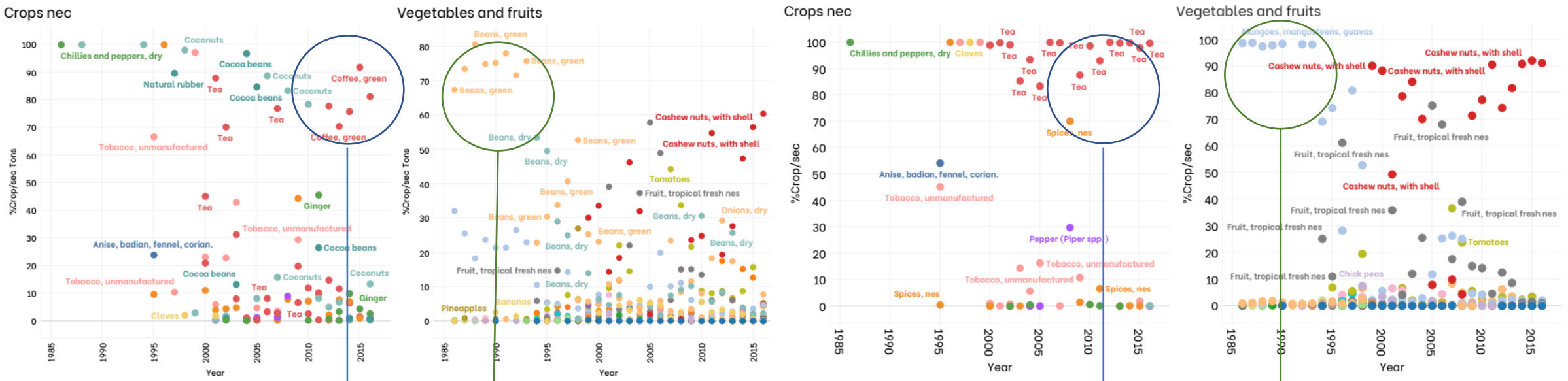


b) Network density for BFA import and export (blue m3)

2) COMPOSITION SECTOR:

a) TONS

b) VWB



Composition of BFA's exports relative to two specific sectors.The data of each product out of the total of the sector considered are reported both in terms of tons percentages (a) or blue virtual water percentages (b)

Coffee green, the most exported crops nec in terms of tons

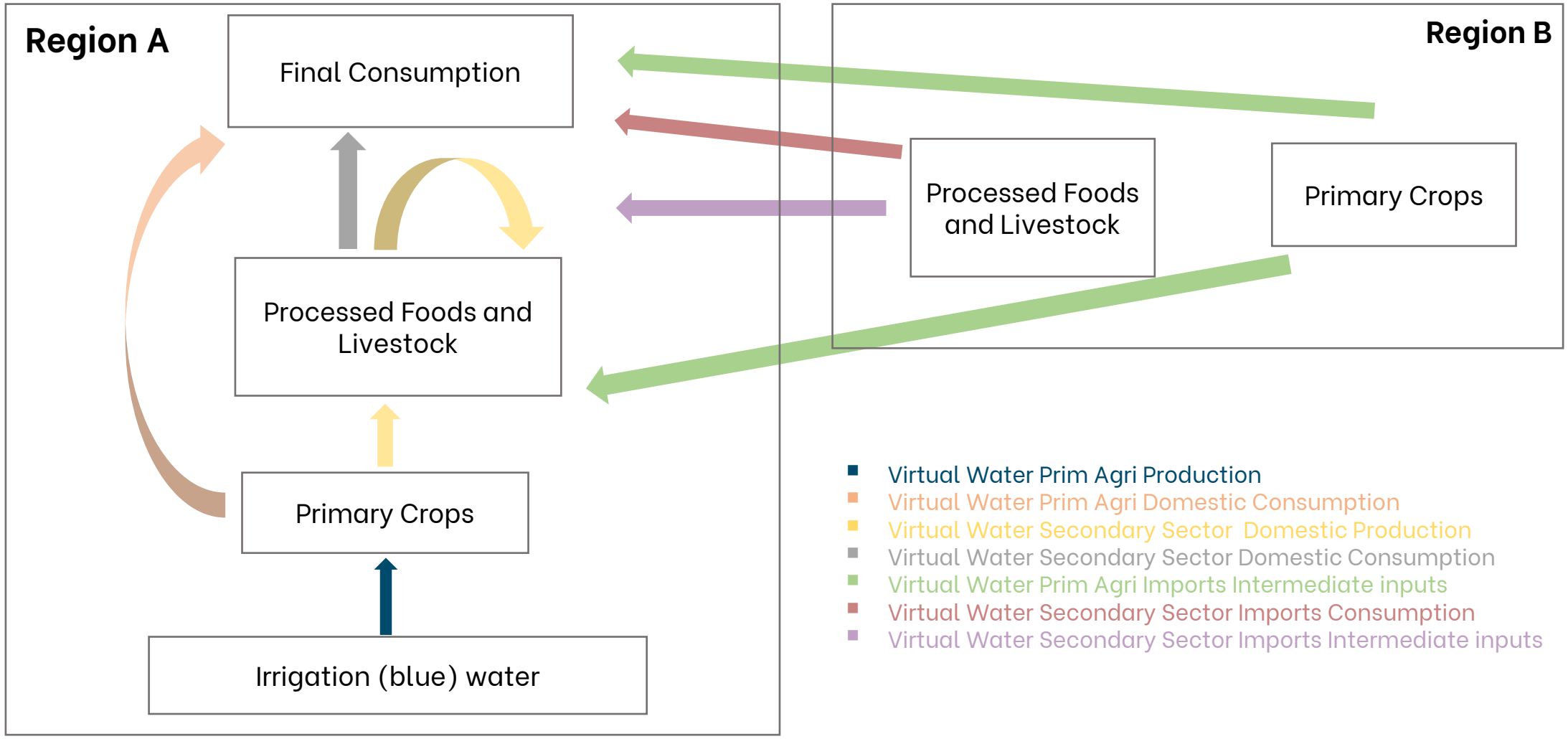
An important quantity in terms of tons of **Green beans** exports

Tea, the most exported crops nec in terms of blue virtual water

Mango's exports account for most of the blue water demand

3) Connecting CWASI and MAGNET

3) MAGNET CONSTRUCTION: water



3) DIFFERENT APPROACHES:

CWASI considers blue waterin terms of or crop water requirements

↓

crop water requirement, defined as the blue water consumed during the growing season

MAGNET considers the water withdrawn for irrigation

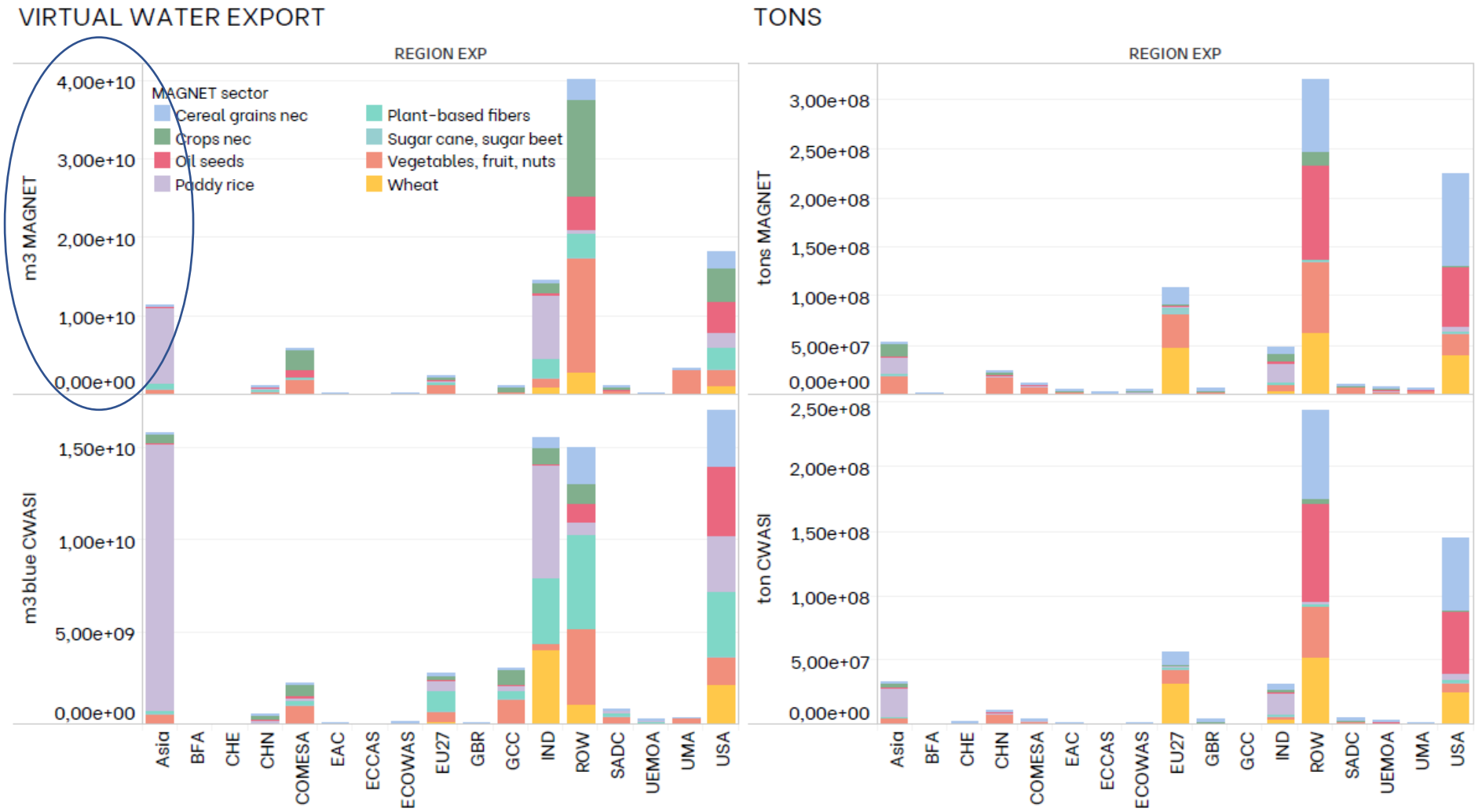
↓

water withdrawn for irrigation by crop, a portion of water withdrawal could return to the surface and/or underground resources

CWASI looks at the water footprint of the crop as blue water (CWASI), whereas MAGNET considers the water withdrawal (so it also includes the water that is potentially "wasted").
On a global scale, the ratio between the two (called the **requirement ratio**) can vary from **20 to 85%.**

3) DIFFERENT APPROACHES:

The virtual blue water flows in CWASI represent 73% of the flows calculated by MAGNET.



3) ADJUSTMENT ON CWASI DATA:

In order to adjust the MAGNET virtual water flows to take into account the actual water use of the agricultural sectors we adjust the water data in MAGNET for both Production and Export of primary products for base year (2014).

PRODUCTION

$$\text{Virtual Water in Primary Crop Production (i, r)} = Prod\ (\boldsymbol{US\$}\ from\ \boldsymbol{MAGNET})_{i,s} \cdot uWFprod\ (\frac{m^3}{US\$}\ from\ \boldsymbol{CWASI})_{i,s}$$

s = producer region

i = whole sector

n = n. crops (c) for each sector s

c = single crop

Where $\boldsymbol{uWFprod}\ (\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}})_{\boldsymbol{i,s}} = \frac{\sum_{c=1}^{n} \text{WFprod}_{s,c}}{\sum_{c=1}^{n} \boldsymbol{US\$}_{s,c}}$

$\boldsymbol{uWFexp}\ (\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}})_{\boldsymbol{i,s}}$ = weighted average of the unit water footprint (weights are the $\boldsymbol{US\$}$ from production for each crop on the total of $\boldsymbol{US\$}$ from the production for the whole sector) of region *s*

3) ADJUSTMENT ON CWASI DATA:

EXPORT

Virtual Water in Primary Crops Exports (i, r, s) =
CWASI Parameter (i, r, s) * Virtual Water in Primary Crop Production (i, r) *
Quantity updated value of Exports (i, r, s) / Quantity updated value of production (i , r)

Where:

$$\text{CWASI Parameter (i, r, s)} = \frac{\left(\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}}\right)_{\boldsymbol{i,r,s\ CWASI}}}{\left(\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}}\right)_{\boldsymbol{i,r,s\ MAGNET}}}$$

r = exporter region
s = exporter region
i = whole sector

n = n. crops (c) for each sector s
c = single crop

Where from CWASI:

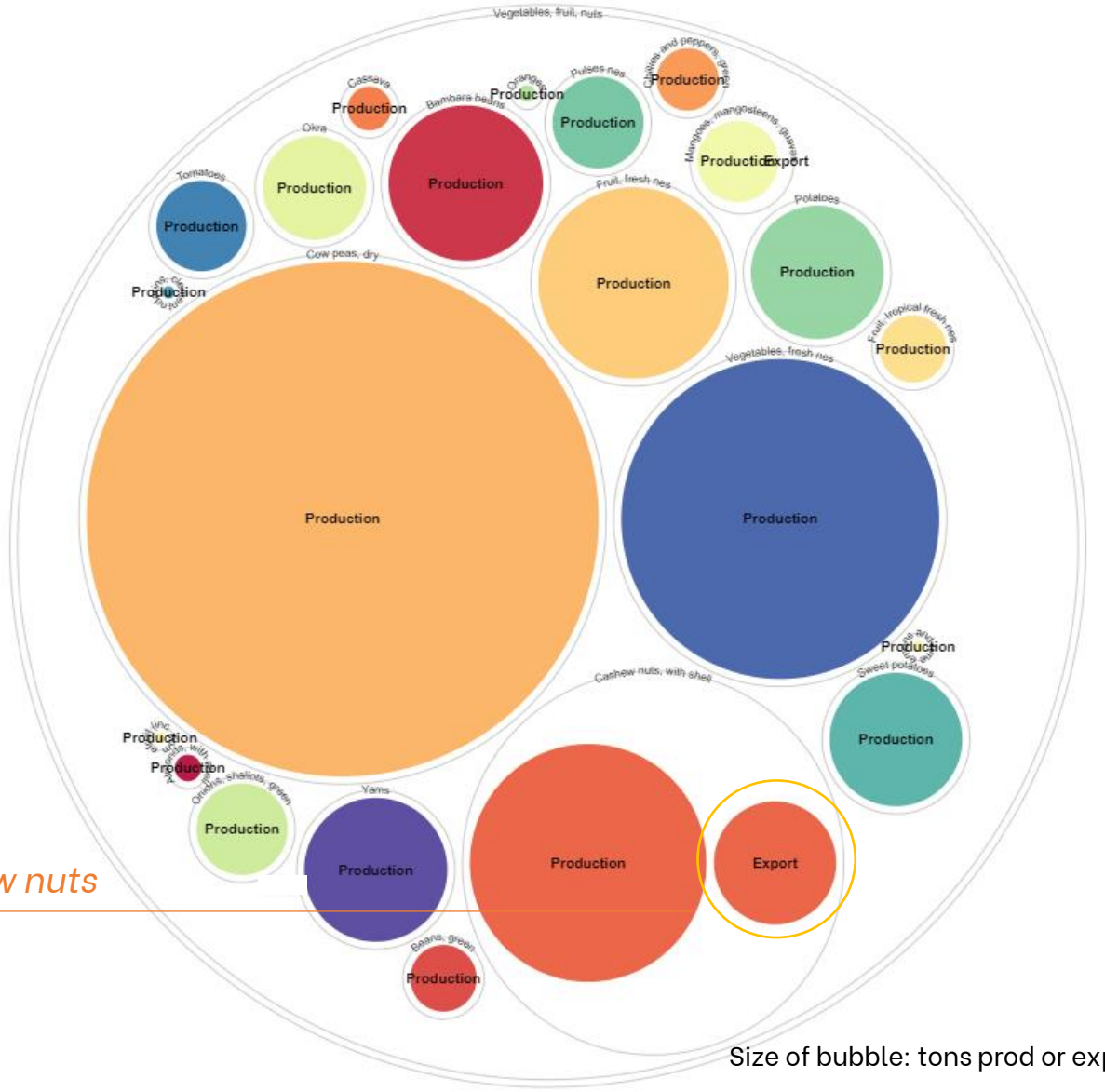
$$\left(\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}}\right)_{\boldsymbol{i,r,s}} = \frac{\sum_{c=1}^{n} \text{VWBexp}_{c,r,s}}{\sum_{c=1}^{n} \boldsymbol{US\$}_{c,r,s}}$$

$\boldsymbol{uWFexp}\left(\frac{\boldsymbol{m^3}}{\boldsymbol{US\$}}\right)_{\boldsymbol{i,r,s}}$ = weighted average of the export unit water footprint (weights are the $\boldsymbol{US\$}$ exported for each crop on the total of $\boldsymbol{US\$}$ exported for the whole sector) exported from region *r* to region *s*;

3) THE IMPORTANCE OF COMPOSITION

The weighted uWF of the Burkina Faso production for the Vegetables, fruits, nuts sector is **87.2** m3/ton.
The weighted uWF of all Burkina Faso exports to Asia (in the example) is **546.1** m3/ton.

The uWF of export is higher than the uWF of **production** because the uWF of production includes a wide variety of products (many of them with **low water demand**), while the **export** (in this case to Asia) is almost exclusively cashew nuts (**high water demand**).



cashew nuts

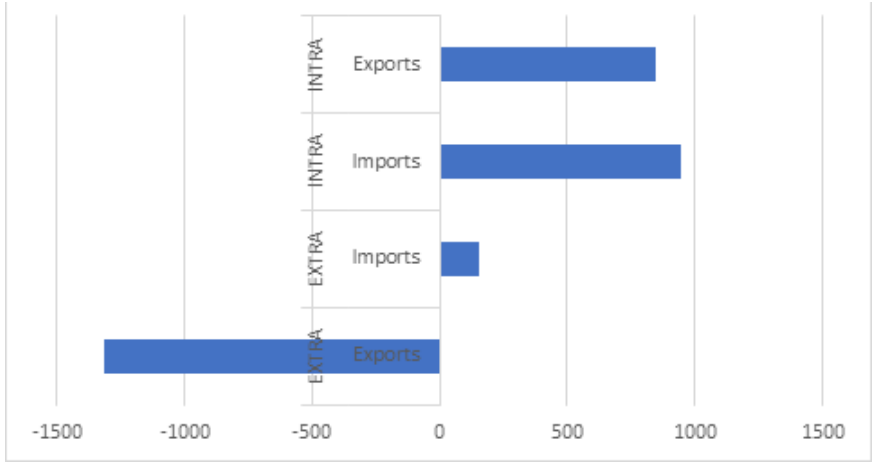
Size of bubble: tons prod or exp

4) POLICY SCENARIO: AfCFTA

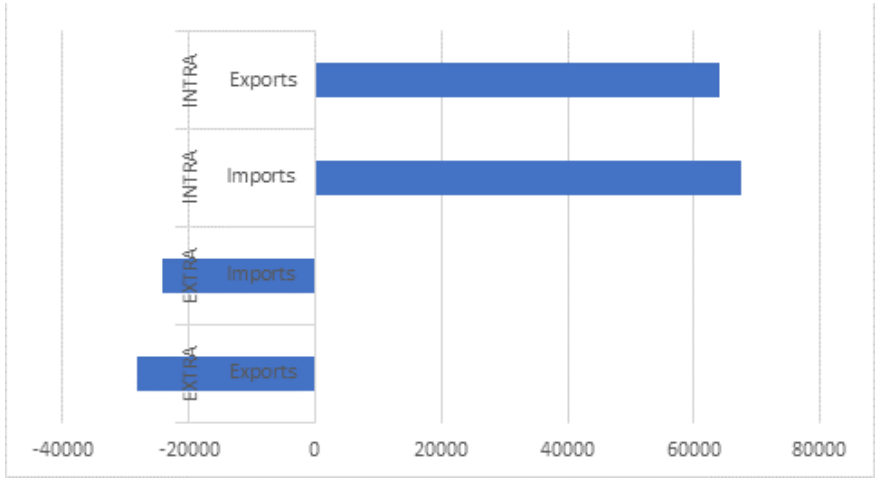
4) IMPACT OF AFCFTA–tariff reductions:

Extra-Continental Trade **Africa**

Change in **primary trade** by 2030 under AfCFTA, million US$



Change in **industry trade** by 2030 under AfCFTA, million US$

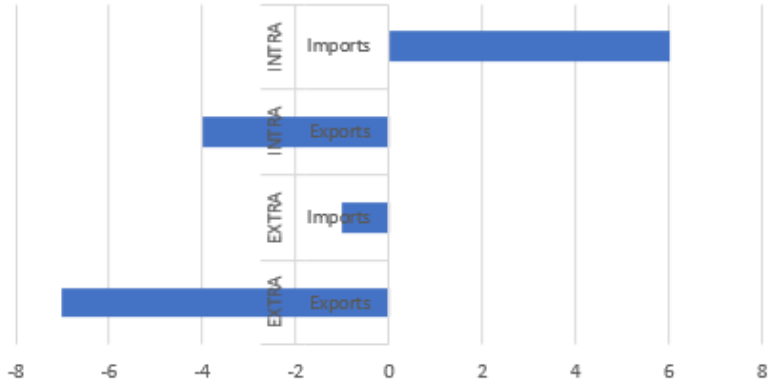


- Shift from primary trade to industry trade;
- ↓ **in trade outside the continent, and** ↑ **in trade within the continent**;
- INTRA-TRADE: for primary products Africa increases both imports and exports;
- EXTRA-TRADE: for primary products Africa drastically decreases exports and slightly increases imports (probably due to GDP increase).;

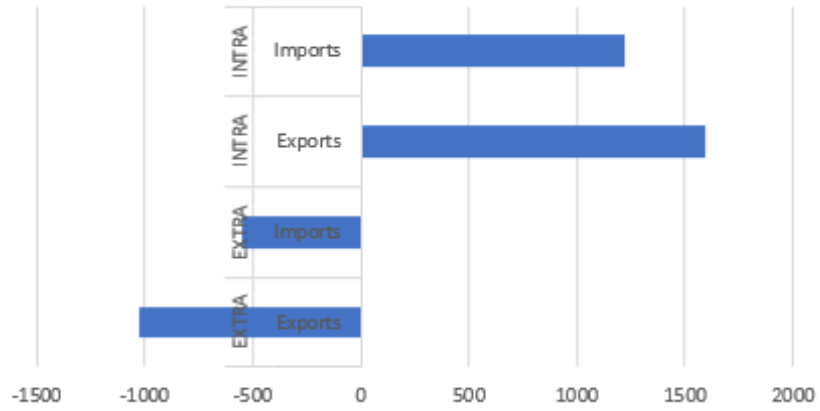
4) IMPACT OF AFCFTA–tariff reductions:

Extra-Continental Trade **Burkina Faso**

Change in **primary trade** by 2030 under AfCFTA, million US$



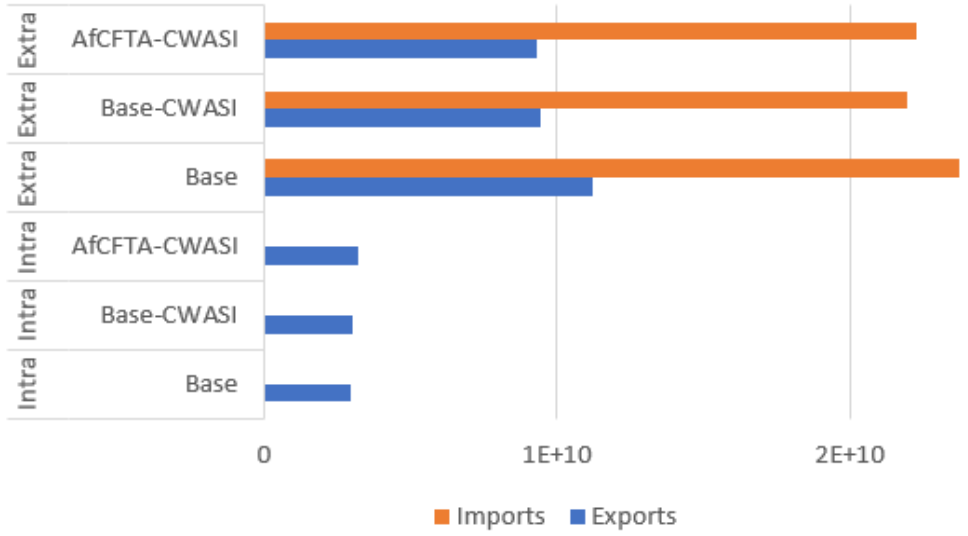
Change in **industry trade** by 2030 under AfCFTA, million US$



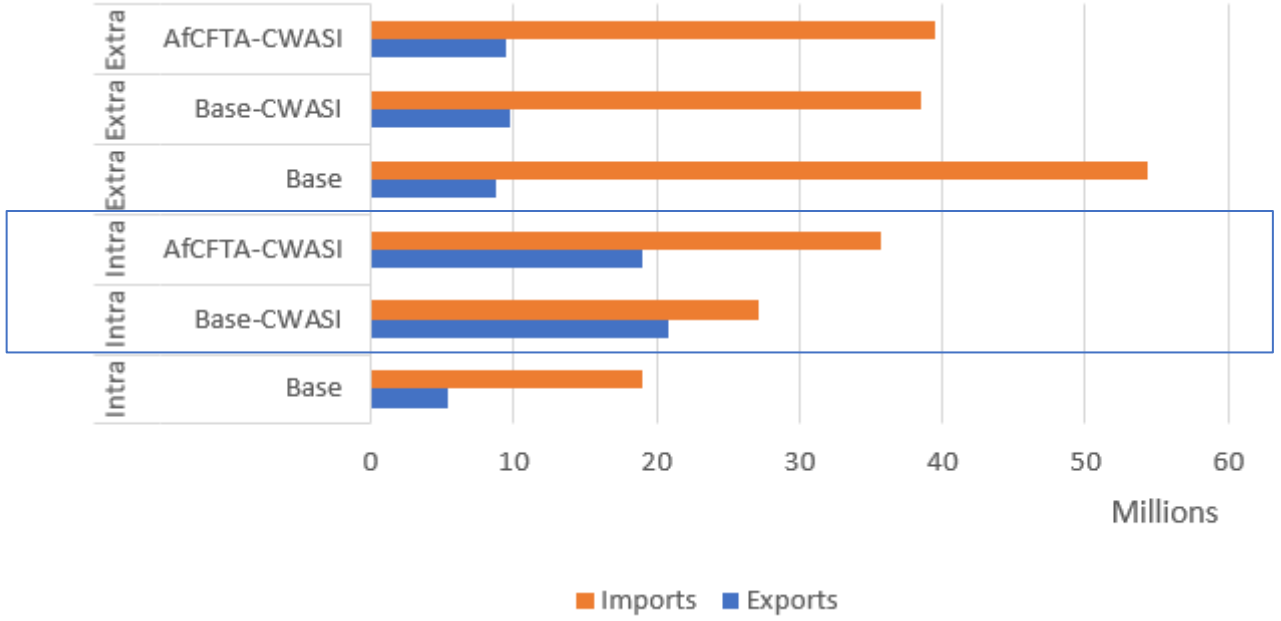
- Shift from primary trade to industry trade;
- ↓ **in trade outside the continent, and** ↑ **in trade within the continent (on average);**
- INTRA-TRADE: for primary products BFA **increases imports** and **decreases exports;**

4) VWF FROM AFRICA-BFA 2030

Virtual water Flows Crops- **Africa** 2030 (m3)



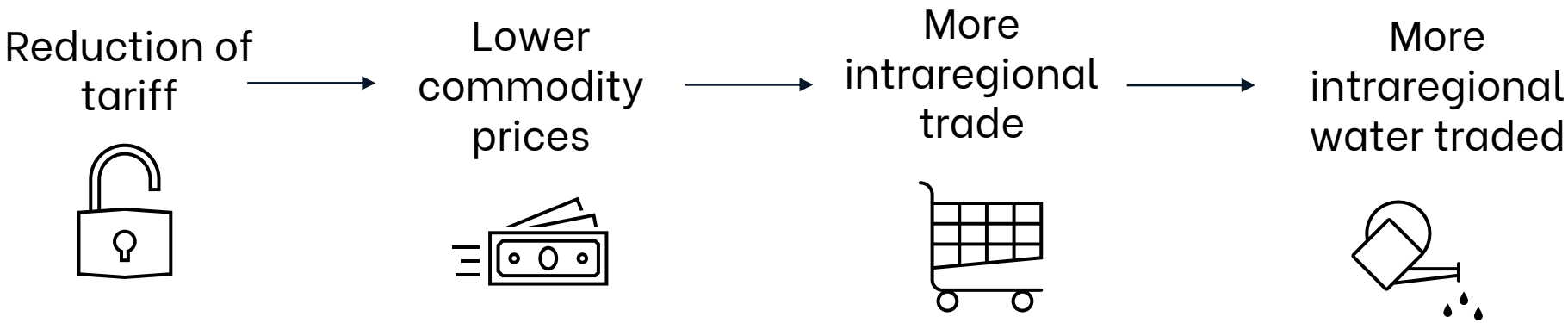
Virtual water Flows Crops- **BFA** 2030 (m3)



-AfCFTA-CWASI : Policy Scenario (2030) with calibration (parameter CWASI)
-Base-CWASI: Baseline Scenario (2030) with calibration (parameter CWASI)
-Base: Baseline Scenario (2030) without calibration

PRELIMINARY RESULTS:

- historical trends (CWASI) show an increase in blue virtual water trade over time;
- For Africa and BFA: the implementation of the AfCFTA scenario in terms of US dollars suggests a shift from agricultural to industrial trade;
- For agricultural products an increase in intra-continental trade in US$;
- Calibration using the parameter obtained from CWASI allows us to have values more similar to those calculated by giving more importance to crops with higher water consumption;



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